REMARKS

Claims 18-25, as amended, are pending herein, claims 1-17 and 26-29 having been canceled.

Claims 18-29 were rejected under §103(a) as obvious over the Matin et al. article titled "Optically Transparent Indium-Tin-Oxide (ITO) Ohmic Contacts in the Fabrication of Vertical-Cavity Surface-Emitting Lasers"("Matin") in view of the patents to Imai No. 5,706,117 ("Imai") and/or Yanagawa No. 5,287,367 ("Yanagawa"). Claims 18-29 were also rejected under §103(a) as obvious over the Lin et al. patent No. 5,838,708 ("Lin et al") in view of the Jiang et al. patent No. 5,751,757 ("Jiang et al").

Parent claim 18 has been amended to clarify that the invention is directed to bottom-emitting VCSELs. Although less common, such VCSELs have several advantages relative to their top-emitting counterparts. They can easily be mounted upside down by a flip-chip technique to CMOS devices, and therefore can be more efficiently cooled. Output monitoring has previously been problematical.

While Matin discloses the use of ITO contacts in a VCSEL, he does so in the vacuum of a purely research context. Matin was investigating the possibility of using ITO as a contact for VCSELs. He says in the introduction that the "use of optically transparent contacts to optimize emission is clearly desirable". He only looks at the optical emission from the output of the laser (low reflectivity mirror). Why he chose to use ITO on both mirrors is not clear from his paper, but it appears since he was investigating the properties of ITO contacts he decided to place ITO on both mirrors to identify its electrical properties. There is no suggestion that Matin placed ITO

contacts on both mirrors because he recognized or taught the value of placing a transparent material on the high reflectivity mirror. Given the state of the art, absent express teaching of the utility of such an expedient, one skilled in the art would not glean any useful information from this teaching other than that ITO can be used as a contact material for VCSELs. Matin only looked at the conventional VCSEL output (i.e. on the low reflectivity mirror side). There is no suggestion that he appreciated the potential value of using ITO on the high reflectivity mirror (normally non-emitting) of a bottom-emitting VCSEL and the possibility that it could be used in a monitoring device in such a mirror. Without making use of the inventor's teachings, one skilled in the art would not recognize Matin as a teaching to put a transparent contact on the non-emitting side of the laser except possibly to prove its utility as a contact material.

It is clear from the description and drawings that both Imai and Yanagawa relate to edge-emitting lasers, not surface-emitting lasers. Such lasers are fundamentally different from Matin in that the light emerges from the side, and thus no contacts are necessary on the surface of the mirrors. There would thus be no motivation for one skilled in the art to apply a transparent contact to either of the mirrors to arrive at the present invention. A combination of Matin and either Yanagawa or Imai does not therefore result in the invention. The Examiner must find the claimed combination in the prior art,- he must not use the applicant's teaching as a blue print - and it is respectfully submitted that this combination of prior art does not meet this strict standard.

Lin et al teaches a bottom-emitting laser, but despite being filed after the publication of the Matin article teaches the exact opposite of the invention, namely that in a bottom-emitting

laser the light output is monitored on the side of the light output. In Lin et al, in Figure 2, the substrate is referenced 212, and the light thus passes through the substrate for output as shown by the wavy arrows. The contact 236 is made transparent and a portion of the output light is absorbed by the contact 236. This generates a photocurrent, which is used for monitoring purposes. The thin metal layer 230, which corresponds to the contact in the invention that is used for monitoring purposes absorbs light (see col. 30, page 5). This is the exact opposite of the present invention. Lin et al teaches monitoring the light on the emission side of the laser, not the rear of the laser.

Applicant respectfully submits that the Examiner has misinterpreted Lin et al in suggesting that the Schottky contact equates to the applicant's photon transparent contact. In Lin et al, the Schottky contact is on the opposite side of the device namely adjacent the substrate in a bottom-emitting VCSEL (see col. 4, line 45). Also, with reference to this embodiment, Lin says at col. 5 line 7 that "if the thickness of the Schottky metal layer is too thick, the emitted light is totally absorbed by the Schottky metal layer, and no light is emitted by the SEL." (emphasis added). By suggesting that the light should be monitored on the emission side of the laser (which of course has the disadvantage that it interferes with the light output of the laser), Lin et al teaches away from the invention and cannot render it obvious.

In summary, the prior art does not disclose or suggest, either alone or in combination, the expedient, which may be simple in hindsight, of making the ohmic contact on a bottom-emitting VSEL (on the side opposite the substrate, i.e. normally the non-light emitting side), and using the leakage light through the high reflectivity mirror for output monitoring purposes. Accordingly,

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reconsideration and withdrawal of the rejections under §103(a) and allowance of claims 18-25 are courteously solicited.

Should the Examiner deem that further amendments to the claims place them in even better condition for allowance, it is requested that he telephone applicant's representative at the telephone number set forth below.

Respectfully submitted,

September 23, 2003

Lawrence E. Laubscher, Jr.
Registration No. 28,233
1160 Spa Road, Suite 2B
Annapolis, MD 21403
Telephone: (410) 280-6608

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Shelly Hubbard

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